terms. For example on page 62 there is a discussion of the nucleal area of a region and the character of the border zone, but the whole matter is expressed in physical terms. The author runs through his list of categories, that is to say his outline, and tells us why he puts things together. But in hardly a single one of the 10 principal subdivisions or the 30 minor subdivisions have we a view of the life of the region in its physical setting. The lack of collation of geographical data is a serious disappointment after the excellent introduction. Nor is the reader greatly helped by a series of 15 maps which illustrate the paper and which give the plant and animal geography, the physical features, etc. They present appropriate and interesting data, but their relationships are left to the reader. In short, the whole paper is less a regional treatment than an essay on the material for a regional geography of Russian Turkestan. Three of the maps, those dealing with the ethnography, the distribution of population, and the agricultural divisions, are taken from the Atlas of Siberian Russia, published in 1914 by the colonization bureau of the Russian Government.

On Formosan Forests

Ryozō Kanehira. **Anatomical Characters and Identification of Formosan Woods with Critical Remarks from the Climatic Point of View.** 2 and 317 pp.; diagr., ills., bibliogr., index. Bureau of Productive Industries, Taihoku, Formosa, 1921. 10 x 7½ inches.

This excellent work is divided into four chapters. Chapter 1 deals with the vegetational character of the ligneous flora of Formosa. Chapter 2 includes the histology of the secondary wood of 386 species together with short notes on external and chemical character such as color, density, flavone content, etc. Chapter 3 is an artificial key for the identification of Formosan woods. Chapter 4 contains a summary and critical remarks from a climatic standpoint. As a basis for the latter, study was made of 160 species of Philippine woods and 181 species from Japan proper.

The island of Formosa lies between latitude 25° 30′ and 21° 40′ N. and longitude 119° and 122° 10′ E. The area is 13,890 square miles, of which about 80 per cent (7,024,000 acres) is forested. Wild peoples inhabit about two-thirds of the forest area.

Topographically the island may be divided into two parts, the mountain district and the plains district, the former being occupied by the central range of mountains which for the most part belong to the Paleozoic formation. This range extends north and south, and many of the highest peaks are more than 12,000 feet above sea level. The existence of these mountains in a tropical and subtropical region is conducive to a very rich forest flora.

The number of known indigenous plants comprises 169 families, 1,185 genera, 3,608 species, and 78 varieties. A study of the geographical distribution of the woody plants of the island shows for 998 elements the following results: Endemic, 36 per cent; China, 18 per cent; Japan, 14 per cent; India, 13 per cent; Malaya, 10 per cent; Philippines, 5 per cent; Australia, 3 per cent; Africa, 1 per cent. There is much evidence that the island was connected with the mainland of Asia until a comparatively recent period.

Three forest types are recognized: (1) Evergreen broadleaf forest, about 2,274,000 acres; (2) mixed broadleaf trees and conifers, about 424,000 acres; (3) pure coniferous forest, approximately 585,000 acres. The coniferous forests are first in economic importance because of the more serviceable timbers they produce. The trees of highest economic value belong to three families, namely, Coniferae, Cupuliferae, and Laurineae. Only a small part of the very rich and extensive forest area is subjected to any form of utilization, partly because of the savage inhabitants but more especially because the whole region is very difficult of access on account of the steepness of the mountains.

From the climatic point of view the Formosan flora may be divided into four zones, namely, tropic, warm, temperate, and frigid. The tropic zone is confined to areas below 1,000 feet altitude and has two distinct types of vegetation, that of the plains region and that of the tidal forests. The latter comprises two subtypes, the mangrove and the beach forest. *Ficus* is the representative tree of the plains district as mangroves are of the coast swamps. Most of the trees of the beach forest are of Indo-Malayan origin, owing their distribution probably to the sea currents. The vegetation of the plains region is highly variable since the land is mostly in cultivation.

The warm zone is mostly occupied by evergreen broadleaf trees, with very few scattered conifers, and comprises a large proportion of the forest. The principal families are Laurineae, Cupuliferae, Urticaceae, Euphorbiaceae, Leguminosae, and Ternstroemiaceae.

The principal trees of the temperate zone are the conifers *Chamaecyparis obtusa* and *C. formosensis*, with certain broadleaf trees often in mixture. Higher up *Pinus Armandi* appears in the sunny places, and large specimens of *Tsuga formosana* are found on the cliffs.

The vegetation of the frigid zone is very simple, with pure stands of *Abies Kawakamii* predominating. Higher up the mountains are grassy slopes with some low shrubs.

The author discusses the local occurrence of trees and shows that, despite the smallness of the island, there are many plants which have only a very local distribution. He also compares the ligneous flora of Formosa with that of Japan and the Philippine Islands. Gymnosperms are represented in Formosa by 14 genera, in Japan by 17, and in the Philippines by only 7. Pine trees are very common in Japan but occur only scatteringly in Formosa. In Japan the most valuable and widely distributed coniferous trees are "hinoki" (*Chamaecyparis obtusa*) and "sugi" (*Cryptomeria japonica*), while in Formosa "hinoki" and "benihi" (*Chamaecyparis formosensis*) are the predominant conifers. "Without 'hinoki,' in Formosa, the utilization of the forest would have been at a very great disadvantage."

As to the dicotyledonous trees, the Philippine flora has a strong representation of the higher orders, the Japanese of the lower; while the Formosan is intermediate. Dipterocarps, the predominant trees of tropical Asia and the most important commercially in the Philippines, have no representatives in Formosa. In striking contrast to the largely deciduous forests of Japan there is very little tropical deciduous high forest in Formosa. "This is due to the climate which has no prolonged dry season; and it is a rather interesting point that in the southern parts of Koshun, where the dry season comes in winter, there are [some] deciduous trees."

SAMUEL J. RECORD

THE RAINFALL MAP OF SOUTHERN AFRICA

J. R. SUTTON. **A Contribution to the Study of the Rainfall Map of South Africa.** Maps, bibliogr. *Trans. Royal Soc. of South Africa*, Vol. 9, 1921, Part 4, pp. 367–414. Cape Town.

The rainfall of South Africa has been studied and charted by several authorities, among them J. G. Gamble, Karl Dove, Raulin, Tripp, Buchan, and others. Buchan's maps are reproduced in Bartholomew's "Atlas of Meteorology," 1899. Recently J. R. Sutton, of Kimberley, who has contributed several valuable studies on various meteorological phenomena of South Africa, especially of Kimberley, has also given attention to the rainfall. Mr. Sutton's first paper, entitled "An Introduction to the Study of South African Rainfall" (published in *Trans. Phil. Soc. of South Africa*, May, 1904) dealt with 160 stations having records of long periods.

In his present contribution Mr. Sutton has used the monthly and annual rainfall values for 567 stations in South and East Africa. Hence he is able to give us a much more complete and accurate cartographic presentation, as well as descriptive and explanatory account, than has heretofore been possible. Most of the computation of the averages was done by the author himself. The aim has been to use all existing records of ten years or more. A good many cover over twenty years, and two (Rietfontein and Kimberley) cover 40 years. Records of less than 10 years have been used for areas not well supplied with gauges, "since it has seemed better to get an approximation to the average rainfall at such places than to ignore them altogether." In only one case has any interpolation been attempted. There is no statement of any reduction of the records to a uniform period. The stations are grouped in 30 sections, 17 of these being essentially those used by the late Meteorological Commission of Cape Colony. Descriptive and explanatory notes are given of each section. The area included extends as far north as to cover southern Angola on the west of the continent and the whole of Portuguese East Africa on the east.

There are thirteen maps (9 by 12 inches) showing the isohyetal lines for the twelve months and for the year, drawn on a base on which the main features of the relief are indicated. One feature of special interest stands out, and that is the few conspicuous instances in which there seems to be any marked influence of the mountains upon rainfall. Topographic effects are seen along the terraces facing the Atlantic, in a few other cases, and, most strikingly, in the Zoutpansbergen of northern Transvaal. The latter are the only obstacle to the unbroken course of the tropical dry belt across the continent. The explanation given by Mr. Sutton is that most South African rainfall comes in thunderstorms,